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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/774,515	02/10/2004	John T. Moore	M4065.0697/P697-A	8694
24998	7590	12/14/2004	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			DOLAN, JENNIFER M	
2101 L Street, NW			ART UNIT	
Washington, DC 20037			PAPER NUMBER	
			2813	

DATE MAILED: 12/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/774,515

Applicant(s)

MOORE ET AL.

Examiner

Jennifer M. Dolan

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 51-70 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 51-55, 57-60 and 64-69 is/are rejected.
- 7) ☒ Claim(s) 56, 61-63 and 70 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>2/10/04, 7/15/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 51, 53-55, 57-60, and 64-69 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,418,049 to Kozicki et al. (cited by applicant; hereafter "Kozicki '049") in view of U.S. Patent No. 6,487,106 to Kozicki (cited by applicant, hereafter "Kozicki '106").

Regarding claims 51, 53, 64, and 65, Kozicki '049 discloses a method of forming a semiconductor memory device (figure 5A) comprising: blanket depositing a metal (530) over a substrate (510; see column 8, lines 13-15); patterning the metal into a structure having an outer surface (figure 5A; column 8, lines 13-15); and blanket depositing a chalcogenide (540) over the substrate and on the metal structure outer surface (figure 5A). Kozicki '049 further teaches that the chalcogenide is doped by diffusing a metal material outwardly into a portion of the chalcogenide (column 4, lines 50-60), and that the electrodes (530, 560) are preferably formed from a material that dissolves in, and hence dopes the chalcogenide (column 4, lines 61-67).

Kozicki '049 fails to specifically teach diffusing the silver from the lower electrode to dope the chalcogenide layer.

Kozicki '106 teaches that a chalcogenide layer is doped by diffusing metal outwardly from either the overlying or underlying electrode of the memory structure, wherein the electrodes are made of a material that dissolves in the chalcogenide, such as silver (column 4, lines 58-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the chalcogenide material of Kozicki '049 is doped by diffusing a portion of the patterned metal lower electrode into the chalcogenide material, as suggested by Kozicki '106. The rationale is as follows: A person having ordinary skill in the art would have been motivated to diffuse the metal material outwardly from the lower electrode, because Kozicki '049 already suggests that the chalcogenide material is advantageously doped by providing an adjacent silver layer, and then diffusing the silver into the chalcogenide, and that the electrodes, which are adjacent to the chalcogenide, should be formed of silver (see Kozicki '049, column 4, lines 52-67). Since Kozicki '106 further indicates that directly diffusing the silver from either the top or bottom electrode into the chalcogenide will suitably dope the chalcogenide, as well as provide advantages of controlling the metal concentration in the chalcogenide to allow for rapid and stable dendrite formation (Kozicki '106, column 4, lines 57-67), it is well within the purview of a person skilled in the art to apply these teachings by diffusing the silver from the patterned lower electrode of Kozicki '049 (figure 5A).

Regarding claims 54 and 55, Kozicki '049 as modified by Kozicki '106 teaches diffusing silver from the bottom electrode (Kozicki '049; figure 5A), as explained supra. Since the bottom electrode must still function as an electrode, and thus must still contain metal, since the chalcogenide is limited in the quantity of metal that it can absorb (see Kozicki '049; column 4, lines 50-60), and since the photo-diffusion process will inherently absorb the outer portions of

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the bottom electrode, it is automatically the case that less than all of the metal of the bottom electrode would be diffused, and the metal electrode would retain substantially the same shape.

Regarding claims 57, 58, 66, and 67, Kozicki '049 discloses that the metal and chalcogenide are irradiated by light with a wavelength of less than 500 nm (column 4, lines 52-60).

Regarding claims 59, 60, 68, and 69, Kozicki '049 teaches that the light wavelength is less than 500 nm, and is selected to be an appropriate wavelength for dissolving the metal into the chalcogenide (column 4, lines 52-60).

Kozicki fails to specifically teach that the wavelength is about 404-408 nm, or about 405 nm.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the wavelength in the method of Kozicki '049 as modified by Kozicki '106 is 404-408 nm. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use a wavelength of 404-408 nm, because the wavelength must be sufficiently small such that its energy is greater than the optical gap of the chalcogenide, in order to efficiently dissolve the metal into the chalcogenide. Hence, the specific wavelength of irradiation would be selected based on routine experiment to find the optimum wavelength for efficient diffusion of the selected metal into the selected chalcogenide material. Although Kozicki only teaches a value of "less than 500 nm", rather than the range of 404-408 nm, it has been held that "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (1955)

3. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kozicki '049 in view of Kozicki '106 as applied to claim 51 above, and further in view of U.S. Patent No. 5,596,522 to Ovshinsky et al. (cited by applicant).

Kozicki '049 fails to teach the method of depositing the chalcogenide material.

Ovshinsky discloses that chalcogenide layers are commonly formed by chemical vapor deposition (column 36, lines 44-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the chalcogenide layer of Kozicki '049 as modified by Kozicki '106 is deposited using CVD, as suggested by Ovshinsky. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use CVD, because Ovshinsky shows that CVD is a common and suitable method for depositing a chalcogenide, and that it is equivalent to and usable interchangeably with other common chalcogenide deposition techniques, such as evaporation or sputtering (Ovshinsky, column 36, lines 44-47).

Allowable Subject Matter

4. Claims 56, 61-63, and 70 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. The following is a statement of reasons for the indication of allowable subject matter: The primary reason for allowability is that the prior art fails to teach providing a patterned metal with an outer surface, and then dissolving the entire metal into the chalcogenide (cl 56) or

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selectively etching the portions of the chalcogenide without the metal doping (cl 61-63 and 70).

For claim 56, the prior art only teaches diffusing metal into the chalcogenide from the electrodes.

Hence, it is not reasonable to modify such prior art by completely dissolving the metal, since

doing so would likewise completely remove the electrode and destroy the ability of the device to

function. For claims 61-63 and 70, the prior art simply provides no suggestion that any of the

chalcogenide would remain undoped, or that it would be in any way advantageous to remove any

undoped portions. Since there is very little art dealing with doping a chalcogenide layer with

metal diffused from an underlying structure and no real basis for modifying the prior art to meet

the limitations of claims 56, 61-63, and 70, it is the examiner's opinion that a person skilled in

the art would have lacked ample motivation for completely dissolving the metal supply layer or

for removing unreacted chalcogenide portions.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690.

The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800